

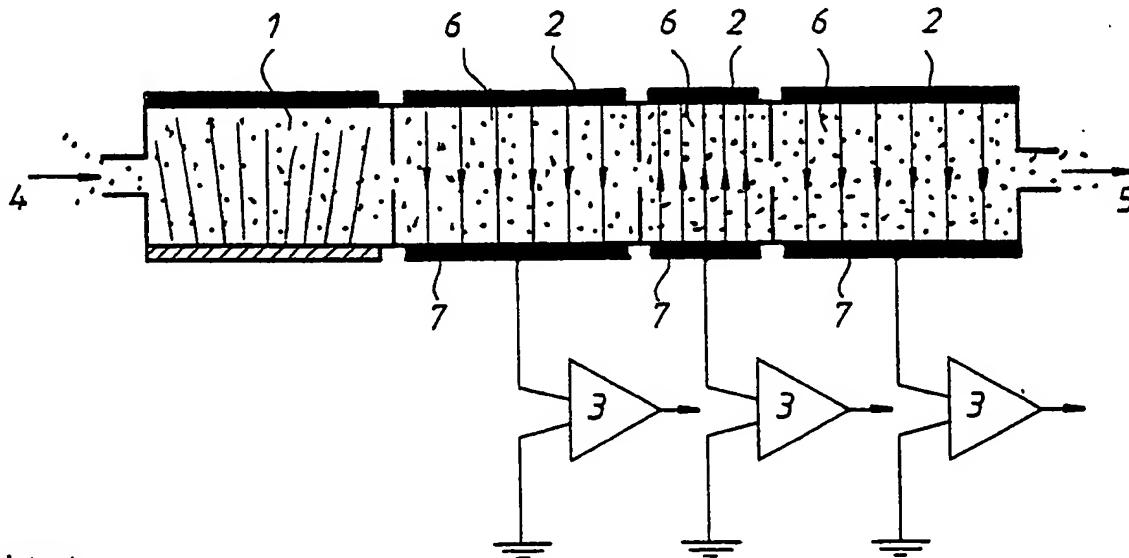


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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| (71)(72) Applicant and Inventor: PUUMALAINEN, Pertti<br>[FI/FI]; Päivärinteentie 3, SF-70300 Kuopio (FI).                                                                                                                                                                                    |                                                       |
| (74) Agent: PITKÄNEN, Hannu; Puijonkatu 24 A 5, SF-<br>70100 Kuopio (FI).                                                                                                                                                                                                                    |                                                       |
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## (54) Title: METHOD FOR DETECTION OF ALIEN MATTER CONTENTS IN GASES



## (57) Abstract

A method for detection of alien matter content in gas, in which method the gas and the materials contained in it are ionized in an ionization room (1). The present methods are inaccurate and unreliable. The invention is based on a method, in which the ionized gas is led through chambers (2) containing different electric fields, out of which at least from one the through the chamber passed field current is measured, from which a signal is obtained, which describes the existence of alien matters in the gas. More parameters are obtained for detection of different materials by measuring favourably the currents passed through several electric field chambers as well as possibly by branching off from the ionization source the flow to different analysis lines of the electric field chambers.

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## METHOD FOR DETECTION OF ALIEN MATTER CONTENTS IN GASES

The objective of the invention is a method for detection of alien matter contents in gases, in which method the gas and the materials contained in it are ionized in an ionizing room.

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For many different purposes it is endeavoured to detect and to measure the contents of alien matters contained in gases. In particular when analyzing from the gas some relatively small quantities containing components, the impurities of the gas may disturb the detection. The detection of different molecules or molecule groups performed from gases in general, from gases attenuated by vacuum pumps or from vapour originating from evaporated solid materials or liquid matters are nowadays connected with problems. In particular the poisonous materials existing in the air, such as from the industry by accident into the air emanated poisonous matters or into the breathing air diffused nerve and other kinds of combat gases, are difficult to detect in a quick and dependable way.

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At the moment mostly is used by taking advantage of the analyzing methods the EC-detector of gas chromatographs, in which method the radioactive radiation is allowed to ionize the carrier gas and the molecules of the alien matters contained in it, the ionized molecules of the carrier gas are permitted partly by means of delaying to recombine themselves, whereafter the iones of the gas are measured. In such a manner for instance is obtained the signal to be measured of the organic substances evaporated into the carrier gas. Measuring devices based on this same principle have also been designed for analyzing of nerve gases from the air. These devices are of two categories: in the first application the ionized molecules are led into a labyrinth, where the own molecules of the air are allowed to recombine themselves and the current of iones caused by

the organic molecules is measured after this. In the other application the entering of the light air molecules into the ione measuring space is impeded by means of voltage grids. This in use being method and the devices for application of it are not sensitive enough when measuring low concentrations such as nerve gases or corresponding from the air or they give a signal also for the other materials or impurities contained by the gas, such as tobacco smoke, exhaust gases, explosion gases, protection smokes etc. substances. Additionally, the cause of the signal can also be for instance a sudden increase in the moisture content of the air, so the measuring outcome is inaccurate and uncertain.

15 The aim of the invention is to bring about a method, by means of which from a gaseous state different alien matter components, their quality and quantity, existing in the gas are measured and detected. In particular the purpose of the invention is to bring forth a method of detecting even a small amount of substance amidst the possibly disturbing other quantities of materials and impurities in a dependable and a quick way. In addition the aim of the invention is to bring about a method of detection in particular of dangerous matters, such as for 20 instance nerve gases or corresponding, and the detection and measuring of the consistence and the quality of 25 these materials.

30 The aim of the invention is achieved by means of the method, for which is characteristic that, what has been presented in the patent claims.

According to the invention the gas and the materials contained by it are led through chambers with different electric fields and an at least through one chamber passed field current is measured, whereby out of the measuring a 35 signal is obtained, which describes the existence of alien

matters in the gas. The whole gas is first ionized and thereafter the flowing gas is treated in different electric fields. At least in one electric field chamber the current between the voltage plates is measured. After 5 that the ionized gas flow has been treated in different electric fields, it is possible to analyze already in one current measuring for instance high molecule organic molecules from the air. A characteristic feature of the invention is, that the moving and the recombining 10 ability of different molecules is taken advantage of in different electric fields, when the whole of the gas has first been ionized.

The method is functioning under atmospheric pressure or 15 in an underpressure, for instance in air thinned by a vacuum pump. The method can also be used in many different chemical analyzing methods, such as in detector of gas chromatograph or in detector of liquid chromatographs, when the materials first are heated or brought into a gaseous 20 state by lowering the pressure. In such a way more resolution capacity is brought into the analyses. With the help of the method in accordance with the invention it is also possible to measure concentrations from a wished group of materials and additionally divide the group into subdivisions, for instance in order to determine the quality of 25 the nerve gas.

In a favourable application of the method from two or more chambers with different electric fields the passed-through 30 flows are measured and the analysis of the materials to be examined is made on basis of the quantities and relations of the flow signals. Hereat different molecule groups can be separated from each other with the help of typical flow signals from different spots.

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In the following the invention is explained more in detail by referring to the attached drawing, in which

figure 1 presents an application of the device system for realization of the method in accordance with the invention in cross-section and seen from the side, and  
5 figure 2 presents an other application of the device system for the applying of the method in accordance with the invention in cross-section and seen from the side.

In the in figure 1 presented application the principle of the method in accordance with the invention has been presented. To the device system belong the ionization room 1, the chambers 2 and the meters 3. Into the chambers 2 has been formed with the voltage plates the traverse electric fields 6 of different magnitude. In the ionization room a suitable radio isotope is used, with the help of 10 the radiation of which the ionization of the gas is taking place. The gas to be examined is brought in this application in by suction through the intake opening 4 to the ionization room 1 and from there the ionized gas is led through the chambers placed after each other through the 15 outfeed opening 5 out of the device system. The flow is obtained in this application by means of an air pump, by which the gas and its component are sucked through the analyzing device system. In the ionization room the ionized molecules and the fragmented molecules are transported 20 through the chambers and through the different electric fields existing in the chambers. Hereby the molecules endeavour to recombine themselves or to destroy their charges and in the different electric fields also ions are removed 25 from the system. In the figure the voltages form together with the earth coupled lower plates field lines into the passage space, and when the intensifiers 3 are coupled to the ground current, it is possible to start treating the signal. By setting two or more flowing measurings in the 30 same flowing channel can at using of electric field of different magnitude different molecule groups be separated 35 from each other with the help of typical flow signals from different spots. By observing the flow signal values

characteristic for each molecule group the observation and measuring result is obtained.

In the application presented in figure 2 the ionization room 1 is in the middle of a mainly sheet-formed body, where the chambers are placed on both sides of the ionization room side by side. To the ionization room several chambers are connected radially or at least channels formed by one chamber. In this application the walls of the chamber are formed by the voltage plates 2 and between the voltage plates the measuring plate 7 is placed. The measuring plate is divided into parts and placed between the voltage plates in such a manner, that the distance between it and the voltage plates varies. Hereby has between the voltage plates been formed at least <sup>2</sup>/minor chambers, the electric field intensity vary from each other. The gas to be examined is led out from the ionization room by changing the route of the gas on the different sides of the measuring plate by taking advantage of the openings in the measuring plate. The parts of the measuring plate are fixed to the one of the voltage plate. From the measuring plates the current is measured against the ground with the help of the intensifiers 3. From the ionization room leave several measuring channels (on the figure two channels) and the voltage plates are in different potentials in regard of the measuring plate 7. Hereby it is possible to start measuring signals right after the ionization, for instance in opposite electric fields against the ground. The alien matter content can be detected and measured by leading ionized gas into the channels of the device system, in which there are chambers with different electric fields, and by measuring the through the chambers passing field current the measuring values are obtained.

One advantage of the structure presented in figure 2 is, that the measuring spots can be made for instance directly on the electronic circuit card and the voltage plates are

on top of the insulations acting as protective sheets for the structure. With the help of this kind of a two-channel analyzer it is possible to measure concentrations of nerve gases, which are below even 0.1 mg/cu.m, when usually as 5 an alarm limit for instance for sarine is considered 0.5 mg/cu.m. The false signals caused by tobacco smoke, combustion gases, explosion gases and protection smokes can be eliminated with this kind of multimeasuring.

10) The invention is not limited to the presented favourable application modes, but it can be transformed within the frames of the attached patent claims. The invention is not connected only with the analyzing of the nerve gases from the air, but it can be used for detection and analyzing 15 of different molecules and molecule groups performed from gas in general, from gas attenuated with the help of a vacuum pump as well as from vapour of evaporized solid or liquid substances.

## CLAIMS

1. Method for detection of alien matter content in gases, in which method the gas and the materials contained in it are ionized in an ionization room (1), characterized in, that the gas and the materials contained in it are led through chambers (2) with different electric fields (6) and the field current passed through at least one chamber is measured (3), whereat from the measuring a signal is obtained, which describes the existence of alien matters in the gas.  
10
2. Method in accordance with the patent claim 1, characterized in, that from two or more chambers with different electric fields the flows passed through them are measured and on basis of the amount and relations of 15 the flow signals the analysis of the materials to be examined is made.
3. Method in accordance with the patent claim 1 or 2, characterized in, that the ionized gas is led to chambers arranged after each other, from which the 20 through them passed flows are measured.
4. Method in accordance with the patent claims 1 or 2, characterized in, that the ionized gas is led into at least two, side by side arranged, from at least 25 one chamber formed channel, and on basis of signals obtained from the measuring signal of at least one chamber of each channel the analysis is made.
- 30 5. Method in accordance with the patent claims 1 or 2, characterized in, that the ionized gas is led to pass between the in the chamber (2) placed, into parts divided flow measuring plate (7) and the chamber wall forming voltage plates varying the route of the gas on different 35 sides of the measuring plate and the distance of the

measuring plate from the voltage plate varying two or more minor chambers are formed in the chamber, the intensity of the electric field of which are different from each other.

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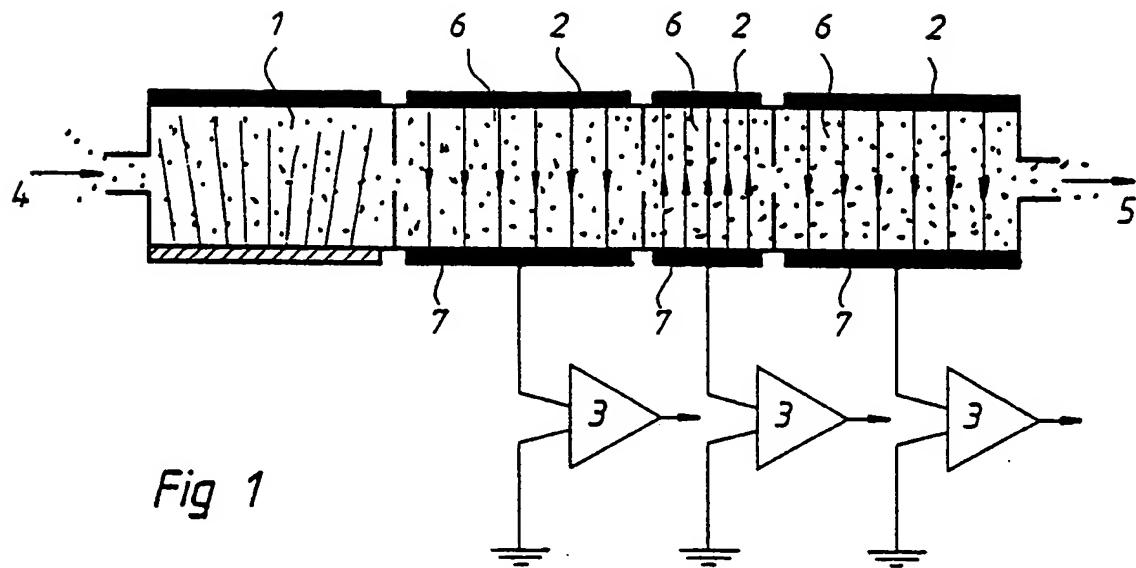


Fig. 1

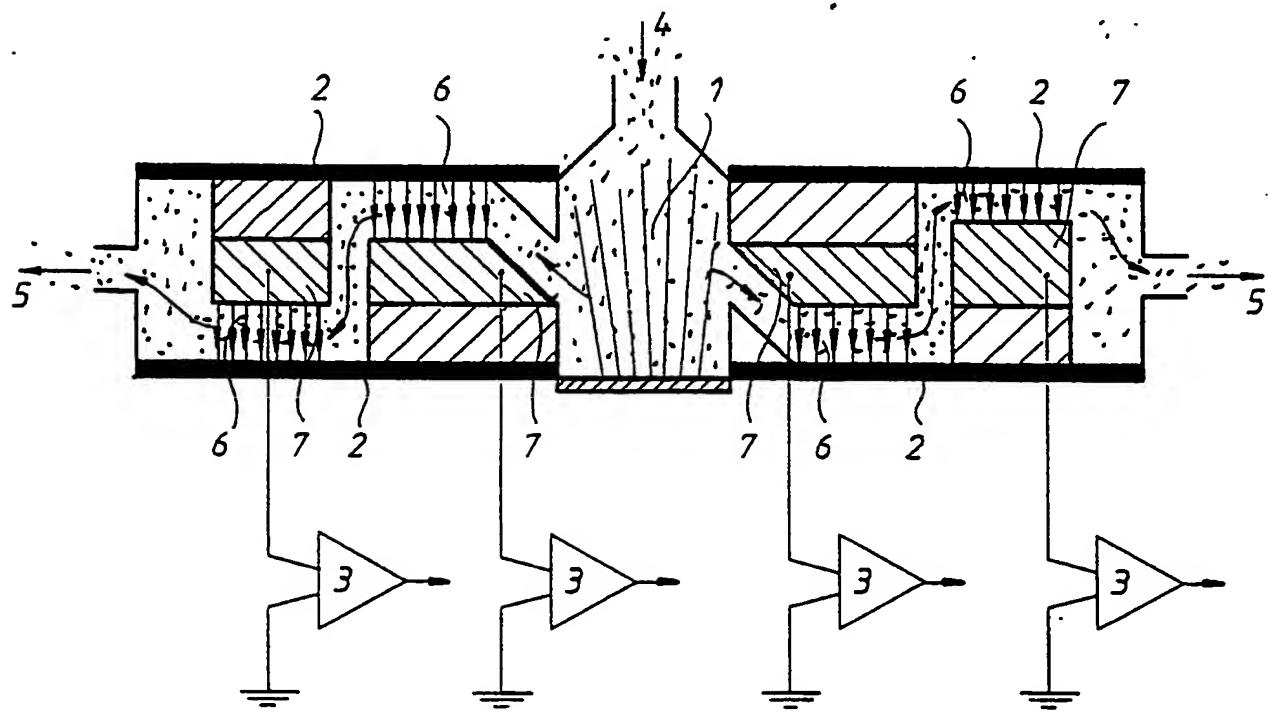


Fig. 2

# INTERNATIONAL SEARCH REPORT

International Application No. PCT/FI87/00075

## I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) \*

According to International Patent Classification (IPC) or to both National Classification and IPC 4

G 01 N 27/62

## II. FIELDS SEARCHED

Minimum Documentation Searched 7

| Classification System | Classification Symbols      |
|-----------------------|-----------------------------|
| IPC 4                 | G 01 N 27/60-/70, 30/64-/72 |
| US Cl                 | 73:26; 324:464; 436:153     |

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched \*

SE, NO, DK, FI classes as above

## III. DOCUMENTS CONSIDERED TO BE RELEVANT\*

| Category * | Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>                                             | Relevant to Claim No. <sup>13</sup> |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| Y          | DE, A1, 2 028 805 (FRANKLIN GNO CORP)<br>16 December 1971                                                                                                  | 1-3                                 |
| Y          | DE, C2, 2 827 120 (HONEYWELL INC)<br>11 January 1979<br>& US, 4119851<br>FR, 2395506<br>GB, 2003312<br>CA, 1110370                                         | 1-3                                 |
| Y          | CH, A, 550 399 (CONSTANTIN GRAF VON BERCKHEIM)<br>14 June 1974<br>& DE, 2261792<br>FR, 2214377<br>GB, 1367440<br>US, 3889180<br>CA, 997423<br>JP, 49091295 | 1-3                                 |
| Y          | EP, A1, 21 518 (PYE (ELECTRONIC PRODUCTS) LTD)<br>7 January 1981<br>& GB, 2052750                                                                          | 1-3                                 |
|            |                                                                                                                                                            | .../...                             |

\* Special categories of cited documents: <sup>10</sup>

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## IV. CERTIFICATION

Date of the Actual Completion of the International Search

1987-08-27

Date of Mailing of this International Search Report

1987-09-01

International Searching Authority

Swedish Patent Office

Signature of Authorized Officer

*Inger Löfgren*

| <b>III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)</b> |                                                                                                                          |                             |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| <b>Category</b>                                                                   | <b>Citation of Document, with indication, where appropriate, of the relevant passages</b>                                | <b>Relevant to Claim No</b> |
| A                                                                                 | JP, 56006153<br>AU, D, 59421/80<br>US, 4317995<br><br>EP, A1, 4 124 (PYE (ELECTRONIC PRODUCTS) LTD)<br>19 September 1979 | 1-3                         |

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